eral weather conditions during the growing season as by soil moisture; that no amount of water would insure good yields in unfavorable years; that increasing the amount of water has little effect on yield, and that very little is to be gained by the application of more than 10 inches of irrigation water. The five-year averages show for the D plats, 13.4 bushels per acre; C, 19.3; B, 19.1; and A, 21.8. The results with oats and barley corresponded in general with those for wheat.

It is of interest to note the amount of irrigation water required to maintain the respective plats at the predetermined moisture content and the relation these amounts bore to the rainfall and winter irrigation. The latter was governed by soil conditions and varied somewhat from year to year, but in general amounted to about 8 inches, that is, the depth to which the water applied would have covered the land if there had been no percolation. The five-year average required during the growing season to maintain the soil moisture at 12 per cent was about 2.5 inches for the sorghums and about 2 inches for the grains. . For the 16 per cent moisture plats, the requirement was about 7 and 7.5 inches, respectively, and for those maintained at 20 per cent, about 13 and 14 inches.

The amounts required in individual years, however, varied greatly from these averages, but they show a very close relation to the amount of winter precipitation. The period covered is so short that a statistical correlation between the several variants could not be considered of much significance, but the relation shown between the amount of irrigation required during the growing season and the precipitation during the preceding fall and winter months is remarkable and the lack of relation between the irrigation water and summer rainfall is surprising. If we combine the three sorghum crops, milo, kafir, and sumac, and count the total number of plats in a given series of each, we have 15 values for comparison. In this case the relation, for example, between the respective B plats, maintained at a moisture content of 16 per cent, and the total precipitation for the period from October to March, inclusive, is represented by the correlation coefficient -0.86. On the other hand, the coefficient between the amount of water applied to these plats and the rainfall during the growing season, April to August, inclusive, is zero, while little or no relation appears to exist between the irrigation water applied in winter and that required during the growing season.

As indications of these relations and lack of relations the following data may be considered: The total winter rainfall October to March, inclusive, for the respective years was 1914–15, 5.5 inches; 1915–16, 3.7 inches; 1916–17, 2.1 inches; 1917–18, 3.8 inches; 1918–19, 9.7 inches. The corresponding summer rainfalls were 18.4, 11.5, 13.2, 9.4, and 8.0. The amount of summer irrigation required to maintain the milo plat at 16 per cent moisture content was 3.4, 9.1, 13.4, 8.8, and 2.6, respectively. It will be noted that for the year 1918–19 when the fall and winter precipitation was 9.7 inches the C plats required no summer irrigation and 2.6 inches were all that was necessary to maintain the B plats at 16 per cent moisture content for milo. On the other hand, the year preceding had only 3.8 inches of winter precipitation, but at the same time 12.7 inches were added by winter irrigation, making a total of winter water of 16.5 inches. In this case, it required 5.9 inches of summer irrigation to maintain the C plats against none for the preceding year and 8.8 inches to keep the B plat supplied with the required moisture against 2.6 for the succeeding year. This would appear to indicate that the winter irrigation had little effect on the summer requirements when compared with the winter precipitation. A much longer series of observations will be required, however, before trustworthy conclusions can be drawn in this connection.

In summing up the results of his experiments, Mr. Knapp presents the following conclusions:

The amount of water required to keep the soil moisture content at a given per cent of saturation varies somewhat with the kind of crops grown.

Crops differ greatly in the amounts of water which they can profitably use, and in the range of yield which can be effected by applying various amounts of water.

Milo shows a marked ability to increase in yield of grain as additional amounts of water are applied, and where the crop receives sufficient irrigation water it is affected less by unfavorable climatic conditions than the other crops included in this experiment. The yield of stover was not greatly influenced by increasing the amount of water.

Kafir exhibits much the same characteristics as milo, but is unable to respond to the application of water to the same extent as milo, so far as this is measured by the yield of grain.

Sumac sorgo was not able to use economically large amounts of water, and showed a slight falling off in yield of stover when more than about 15 inches was applied.

Sudan grass grown in rows for seed is not a profitable irrigation crop, and when it is so grown it should not be irrigated heavily.

The yields of small grain crops such as wheat, oats, and barley are controlled to a greater extent by prevailing weather conditions than by available amounts of water, and no amount of water has sufficed to insure good yields in years of adverse weather conditions.

THE WEATHER OF 1922.

By A. J. HENRY.

Cyclones and anticyclones.—The number of cyclones (189) and of anticyclones (129) which appeared within the field of observation during the year was considerably in excess of the 20-year average. That fact, however, does not necessarily indicate a year of greater storminess as some writers claim. The word "storminess" is, at best, a vague term when applied to average conditions unless the writer indicates clearly what is meant. The suffix "ness," added to the root "stormy," must mean, at least, greater violence of the winds, an increased amount of both cloudiness and precipitation. All of these characteristics are amenable to exact observation and tabulation and it is an easy matter to ascertain whether or not any given period has been one of strong winds, great precipitation, and naturally much cloudiness. The record of cyclones for the year very clearly shows that increased storminess can not be predicated upon a large number of cyclones. The important point to be remembered is that quality rather than quantity is the determining factor.

Precipitation.—Considering the United States as a single geographic unit its weather during 1922 may be briefly characterized as warm and moderately dry. More rain fell than in 1921, but the distribution throughout the year was very uneven. After a rainy spring and early summer, a shortage of rain was felt in more or less restricted areas in Atlantic Coast States, the Ohio Valley, and portions of the Plains States. The monthly distribution by climatological districts is shown in Table 1 and the departures from normal on chart A. J. H. II. This shortage continued, mostly in eastern districts, throughout November, and by that time the shortage of water for manufacturing purposes and even for domestic use had become acute in portions of the Middle Atlantic States. Deficient rainfall was also the rule in Pacific Coast States, especially in Washington and Oregon.

The months of March, April, May, and June, the latter in eastern districts only, on the other hand, were months of abundant rains east of the Rocky Mountains; the rains of the two months first named laid the foundation for at least three great floods, as follows: (1) The Mississippi from the mouth of the Arkansas to the Passes, in which stretch of the river the greatest flood [1] of record culminated in June; (2) the rivers of Texas in April and May, including the flood of the lower Rio Grande in June; (3) the flood in the lower Colorado in California in May. Damaging floods, more or less local, occurred in the basins of the Delaware and Susquehanna in June and in the rivers of northwest Missouri in July due to repeated heavy downpours of rain.

[1] A detailed report of this flood will shortly appear in MONTHLY WEATHER REVIEW SUPPLEMENT NO. 22 (The Spring Floods of 1922), by H. C. Frankenfield, Chief, River and Flood Division, Washington, 1923.

TABLE 1.—*Monthly and annual precipitation departures, 1922.*

Districts.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
New England	−1.4	−0.2	+0.7	−0.2	+0.8	+3.5	−0.2	+1.8	−1.1	−0.9	−2.4	−0.3	+0.1
Middle Atlantic	0.0	−0.4	+1.1	−1.1	−0.3	+2.2	+0.8	−0.3	−1.4	−0.8	−2.2	−0.0	−2.4
South Atlantic	−0.1	+1.5	+1.2	−0.2	+1.9	+0.4	−0.2	−0.9	−1.0	+1.8	−2.3	+0.6	+2.7
Florida Peninsula	−1.3	−0.9	−1.9	−1.6	+1.6	−3.3	+1.0	−0.3	+0.4	+5.2	+1.1	+0.6	+0.5
East Gulf	+0.6	+1.3	+2.6	−0.7	+2.9	−0.6	+0.4	−0.9	−2.4	+0.7	−1.4	+2.3	+5.0
West Gulf	+0.1	+0.1	+1.4	+2.5	+0.7	−0.1	−1.3	−1.7	−0.1	+0.1	−0.3	−1.5	−0.1
Ohio Valley and Tennessee	−1.4	−0.9	+2.6	+1.0	−0.3	−0.7	+0.1	−0.2	−0.4	−1.0	−1.7	+1.6	−1.3
Lower Lakes	−0.8	−0.5	+1.5	+0.4	−0.8	+1.6	−0.7	+0.4	−0.9	−0.9	−1.6	−0.3	−2.6
Upper Lakes	−0.8	+0.8	+0.4	+1.0	−0.9	−0.4	+0.6	−0.6	+0.5	−1.1	0.0	−0.8	−1.3
North Dakota	−0.2	+0.3	−0.2	−0.8	+0.5	−0.4	−0.8	−1.2	+0.5	−0.7	+1.3	+0.2	−1.5
Upper Mississippi Valley	−0.5	+0.5	+1.2	+0.6	−0.5	−2.3	+0.6	−1.2	−0.9	−0.9	+1.2	−0.6	−2.8
Missouri Valley	+0.1	+0 1	+1.5	+0.9	−1.2	−1.6	+0.8	−1.8	−0.7	−0.6	+2.0	−0.6	−1.1
Northern slope	−0.1	−0.1	−0.6	+0.7	−0.1	−1.1	+0.6	+0.1	−0.6	−0.4	+0.7	−0.1	−1.0
Middle slope	−0.1	+0.2	+1.0	+2.0	−0.2	−1.8	+0.6	−1.0	−0.8	0.0	+1.4	−0.6	+0.7
Southern slope	−0.2	−0.3	+0.7	+2.9	−0.4	+0.3	−1.6	−1.9	−1.9	−0.9	−0.2	−0.8	−4.3
Southern Plateau	0.0	−0.2	−0.1	0.0	−0.2	−0.2	−0.5	−0.4	−0.2	−0.5	+0.1	+0.4	−2.2
Middle Plateau	0.0	+0.7	−0.4	−0.2	−0.3	−0.1	+0.2	+0.6	−0.6	−0.5	+0.2	+0.6	+0.2
Northern Plateau	−0.6	−0.2	−0.4	−0.1	−0.9	−0.6	−0.4	+0.8	−0.5	−0.5	−0.8	+0.3	−3.9
North Pacific	−3.9	−2.0	+0.6	−0.5	−0.5	−1.7	−0.7	+0.8	+0.2	+0.1	−4.2	+0.7	−11.1
Middle Pacific	−2.3	+1.2	−1.4	−1.5	−0.7	−0.3	0.0	0.0	−0.5	+1.0	+0.2	+1.8	−2.5
South Pacific	+1.0	+1.1	−0.6	−0.8	0.0	0.0	0.0	0.0	−0.2	−0.5	+0.8	+1.2	+2.0

Temperature.—The tendency to above-normal temperature which has prevailed on this continent for some time continued through out the year, excepting only the area between the Rockies and the Pacific—an area that often differs in temperature distribution from the remainder of the country.

The dividing line between areas of positive and areas of negative temperature departure is shown on Chart A. J. H. I. The cold weather of January west of the Rockies brought freezing temperatures and considerable financial loss to citrus growers in southern California.

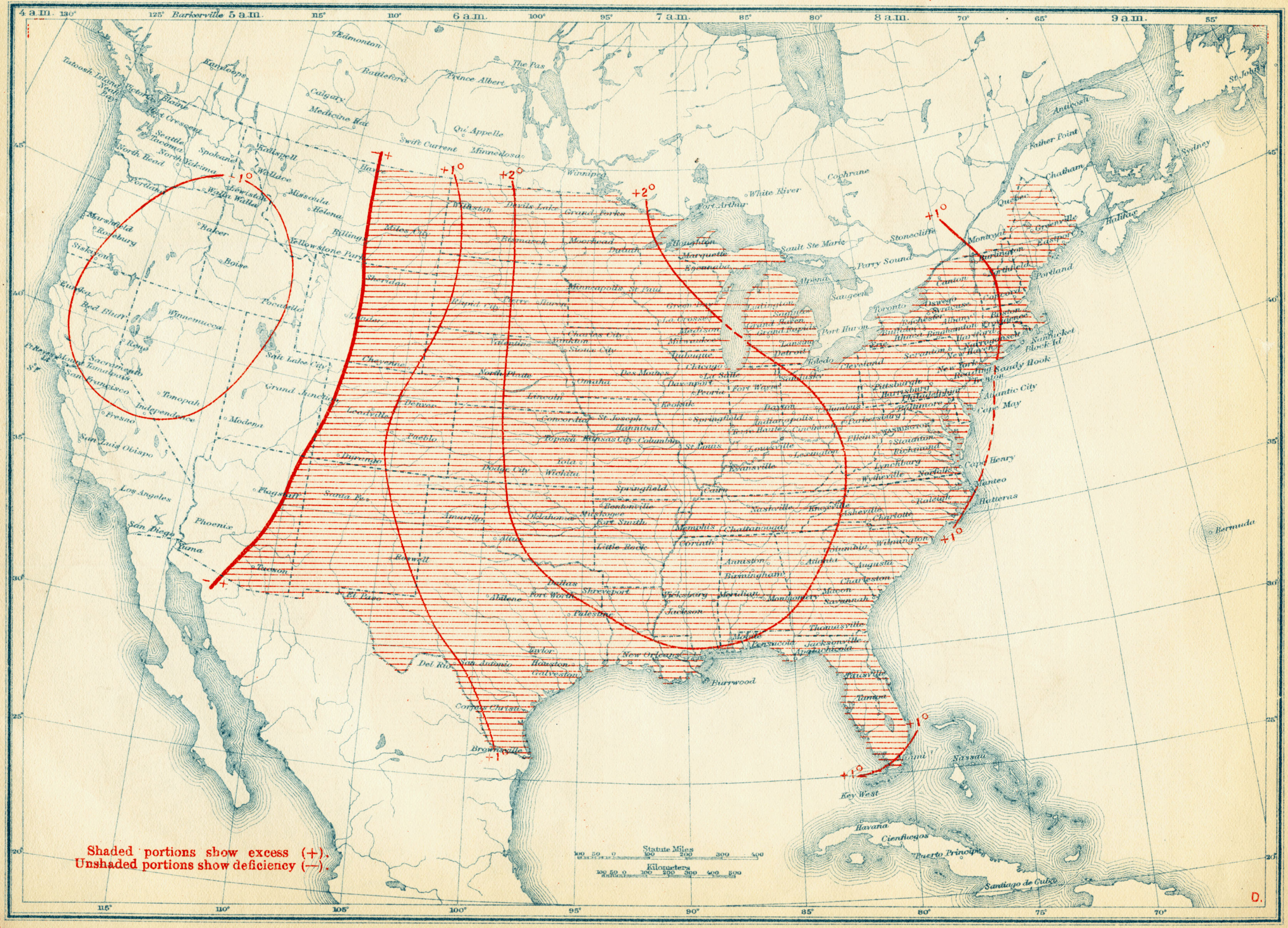
The tendency of the temperature distribution to continue in the same sense for several months is well illustrated by the departure charts published in this REVIEW for February, March, April, and May, 1922, in all of which subnormal departures are shown for the region west of the Rockies. In June temperature was everywhere above normal except a small area in western Texas. In July temperature was below normal over a large area east of the Rockies and above normal to the westward, a reversal of the prevailing conditions. This reversal soon came to an end in August, the subnormal area appeared on the Atlantic coast states in the east and in a part of the Pacific coast area only.

Table 2 shows the departures by month and for each of the 21 climatological districts into which the United States have been divided.

TABLE 2.—*Monthly and average monthly temperature departures, 1922.*

Districts.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Average monthly departure.
New England	−1.4	+1.7	+3.3	+1.8	+3.1	+1.6	−0.7	+0.1	+1.6	+0.8	+1.4	−2.0	+1.0
Middle Atlantic	−1.2	+3.7	+3.4	+2.2	+2.7	+1.6	−0.5	−1.5	+2.0	+2.4	+1.9	+1.1	+1.5
South Atlantic	−0.5	+5.1	+2.7	+2.8	+0.9	+1.4	+0.3	−2.2	+1.0	+1.6	+1.6	+4.8	+1.6
Florida Peninsula	+1.1	+2.6	+2.3	+3.0	−0.2	+0.1	−0.7	−0.7	−0.7	+1.2	+1.8	+4.0	+1.2
East Gulf	+1.6	+5.5	+0.7	+3.3	+0.5	+1.1	−0.4	−0.3	+2.6	+0.6	+3.2	+7.0	+2.1
West Gulf	−0.9	+4.1	−0.7	+1.9	+2.0	+0.8	+0.4	+2.0	+2.8	+1.3	+2.6	+5.9	+1.8
Ohio Valley and Tennessee	−0.3	+3.9	+3.3	+2.8	+2.7	+1.4	−0.8	−0.7	+3.5	+2.5	+2.7	+3.0	+2.0
Lower Lakes	−1.9	+3.6	+3.6	+1.9	+3.6	+0.8	−0.6	−0.3	+2.6	+0.8	+2.8	−0.2	+1.4
Upper Lakes	−0.2	+0.7	+4.1	+1.5	+6.0	+1.7	−1.2	+1.0	+3.4	+1.7	+4.8	−1.8	+1.8
North Dakota	+3.0	−6.0	+5.6	+2.6	+3.2	+1.8	−2.0	+4.8	+3.4	+3.3	+6.4	−2.9	+1.9
Upper Mississippi Valley	+0.6	+2.2	+4.1	+1.0	+3.7	+2.3	−1.9	+1.8	+3.3	+4.2	+5.5	+0.3	+2.2
Missouri Valley	+2.2	−0.1	+4.1	+2.0	+2.0	+3.1	−1.8	+3.5	+4.6	+4.0	+4.9	+0.4	+2.4
Northern slope	−3.1	−7.5	+0.3	−1.9	−0.2	+3.6	−0.9	+3.9	+4.4	+3.9	−1.3	−3.4	−0.2
Middle slope	+0.2	+2.3	+0.6	−0.8	+0.5	+2.6	−0.4	+4.1	+4.1	+2.7	+2.1	+3.0	+1.8
Southern slope	−1.2	+3.5	−0.1	0.0	+0.6	−0.7	+1.1	+4.0	+2.9	+1.0	+1.7	+4.2	+1.4
Southern Plateau	−3.0	−1.6	−3.1	−3.7	+0.5	+1.2	+1.2	+1.4	+3.5	+0.9	−2.9	+2.9	−0.2
Middle Plateau	−7.5	−3.8	−3.7	−5.4	0.0	+3.8	+1.5	+0.2	+4.2	+1.3	−3.3	+2.0	−0.9
Northern Plateau	−8.5	−3.3	−2.9	−4.2	−1.4	+4.8	+3.1	+1.9	+3.4	+4.0	−3.2	−4.2	−0.9
North Pacific	−3.1	−1.6	−2.5	−2.6	+0.2	+1.8	0.0	−0.3	+1.7	+1.8	−1.1	−2.4	−0.7
Middle Pacific	−3.7	−2.1	−2.2	−2.4	+0.8	+1.5	+1.7	0.0	+2.8	−0.6	−3.0	−0.6	−0.6
South Pacific	−2.1	−0.7	−1.7	−2.3	+0.8	+1.4	+0.9	+1.2	+4.3	+0.5	−2.0	+2.1	+0.2

A. J. H. I. **Annual Temperature Departures (°F.) in the United States, 1922.**



Shaded portions show excess (+).
Unshaded portions show deficiency (—).

A. J. H. II. Annual Precipitation Departures (inches) in the United States, 1922.